Spatial patterns in the seasonal evolution of ozone and CO as seen by TES, and the effects of the geographically variable a-priori used in the TES retrieval.

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- The TES retrieval (optimal estimation) uses climatological distribution as a constraint for ozone and CO.
- The constraint (prior) for the spatial distribution of ozone and CO is from the MOZART model, binned monthly in blocks of 10°x60° (lat. x long.).
- The TES retrieval uses a constraint matrix in five latitude bins, with boundaries at ±18°, ±54° N and S. This is a smoothing constraint.
- TES V002, at DAAC now

Our goal:

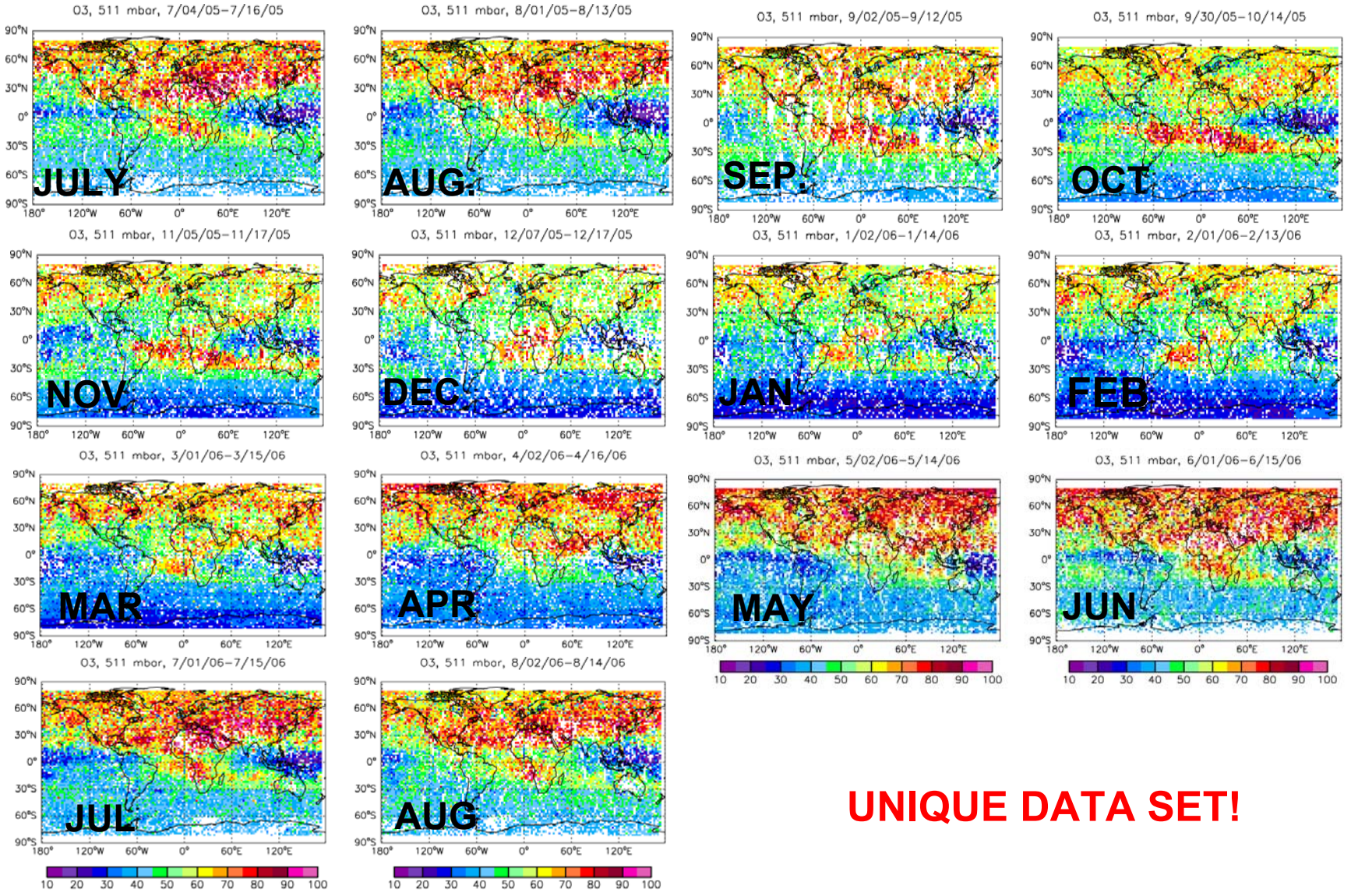
To explore the effects of the variable prior on global distributions by replacing the MOZART prior with a monthly uniform prior (from averaging the MOZART prior).

TES data were selected using the master data quality flags.

Outline

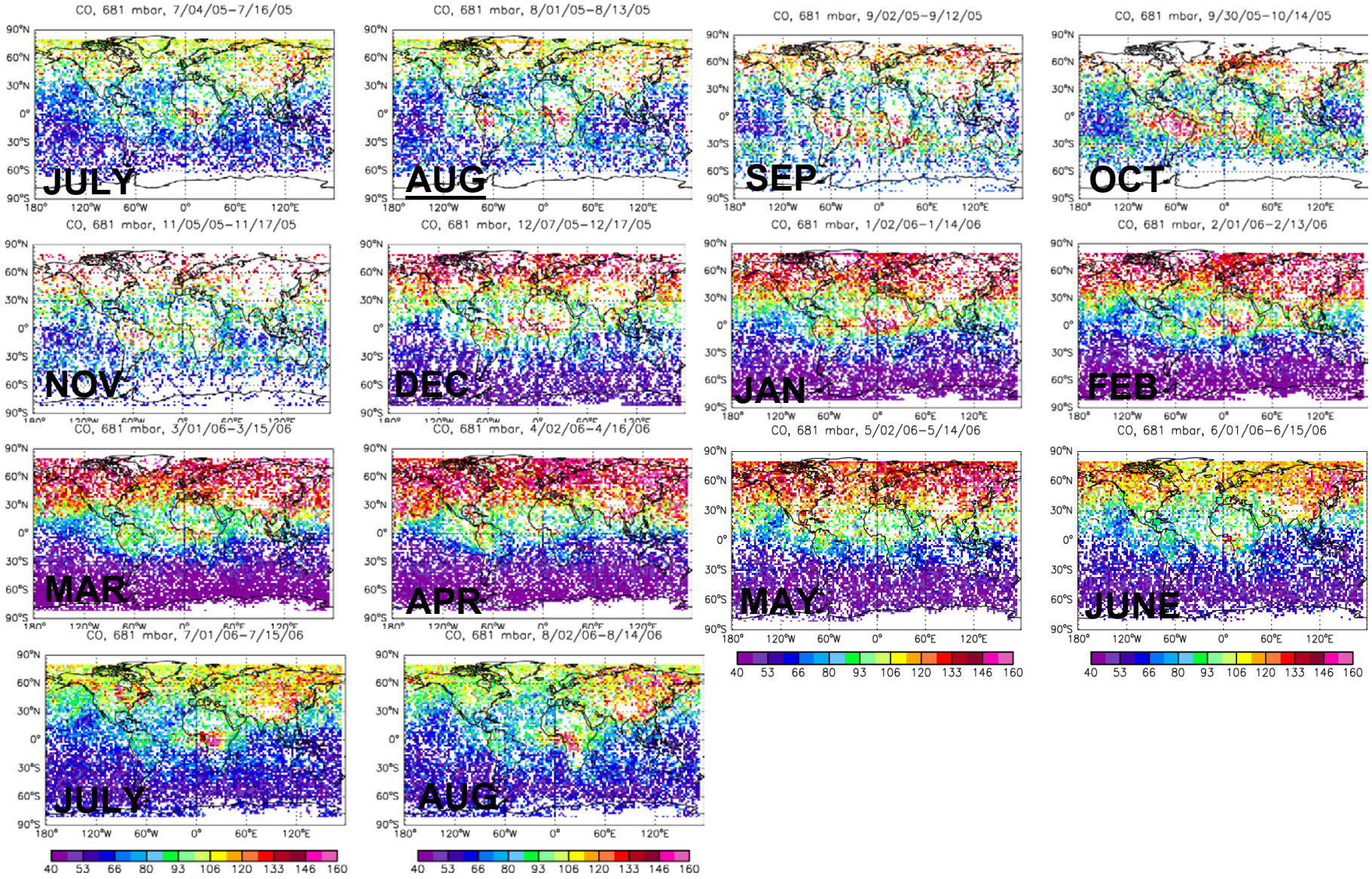
- Show the seasonal evolution of TES ozone and CO global distributions for 14 months, July 2005 to August 2006.
- Results are shown for the first 2 weeks of each month – TES global surveys repeat in 16 days.
- Highlight examples of where the spatial pattern of the prior is apparent in the retrieved product.
- Comparisons of standard retrieval to that with a uniform prior for that month.
- Highlight other artifacts introduced by assumptions in the retrieval.
- Discuss problems introduced by the use of a globally uniform prior.
- Discuss cases where a uniform prior is useful

Seasonal evolution of ozone at 500 hPa, July 2005-August 2006 (2°x2.5° grid)



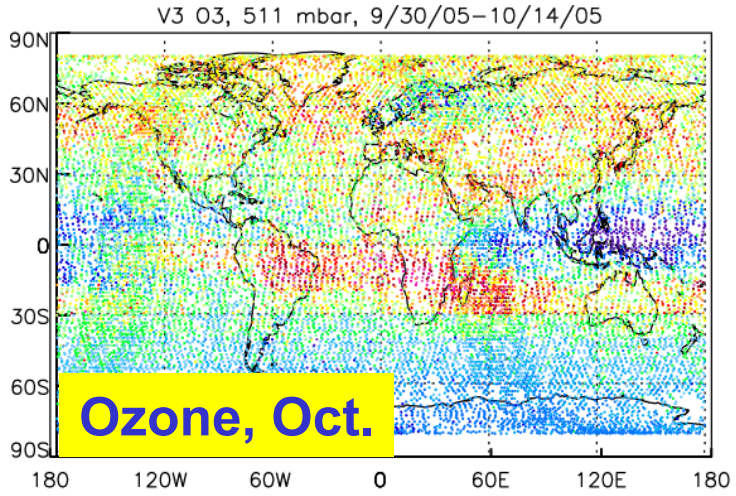
UNIQUE DATA SET!

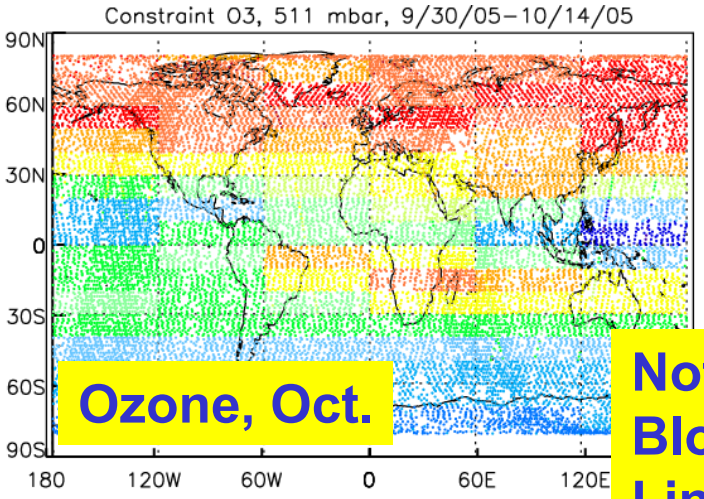
Seasonal evolution of CO at ~700 hPa, July 2005-August 2006



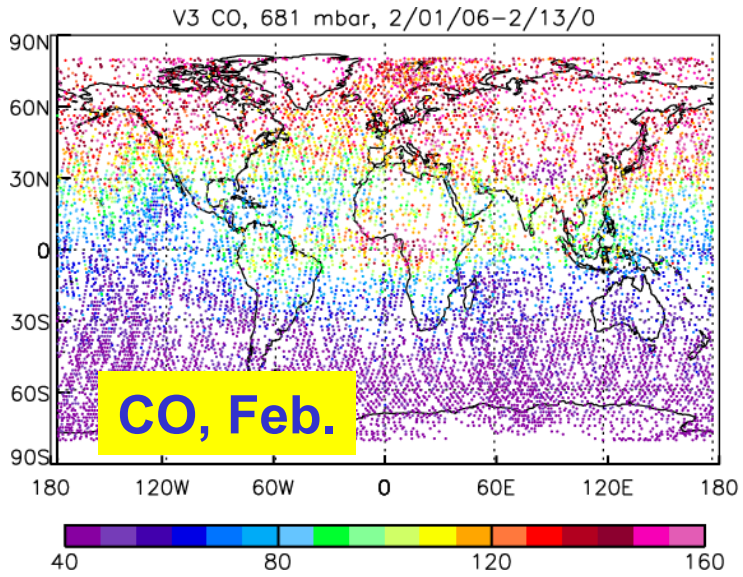
Standard retrieval

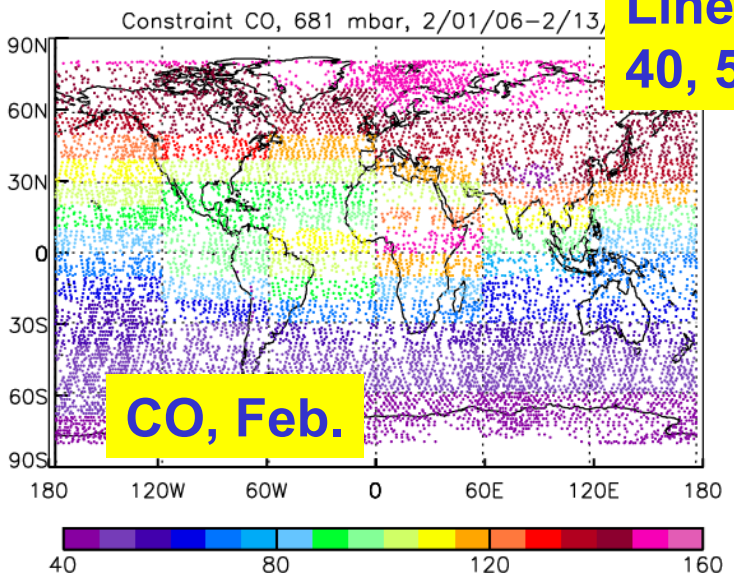
Prior, from MOZART, 10°x60 ° avg.



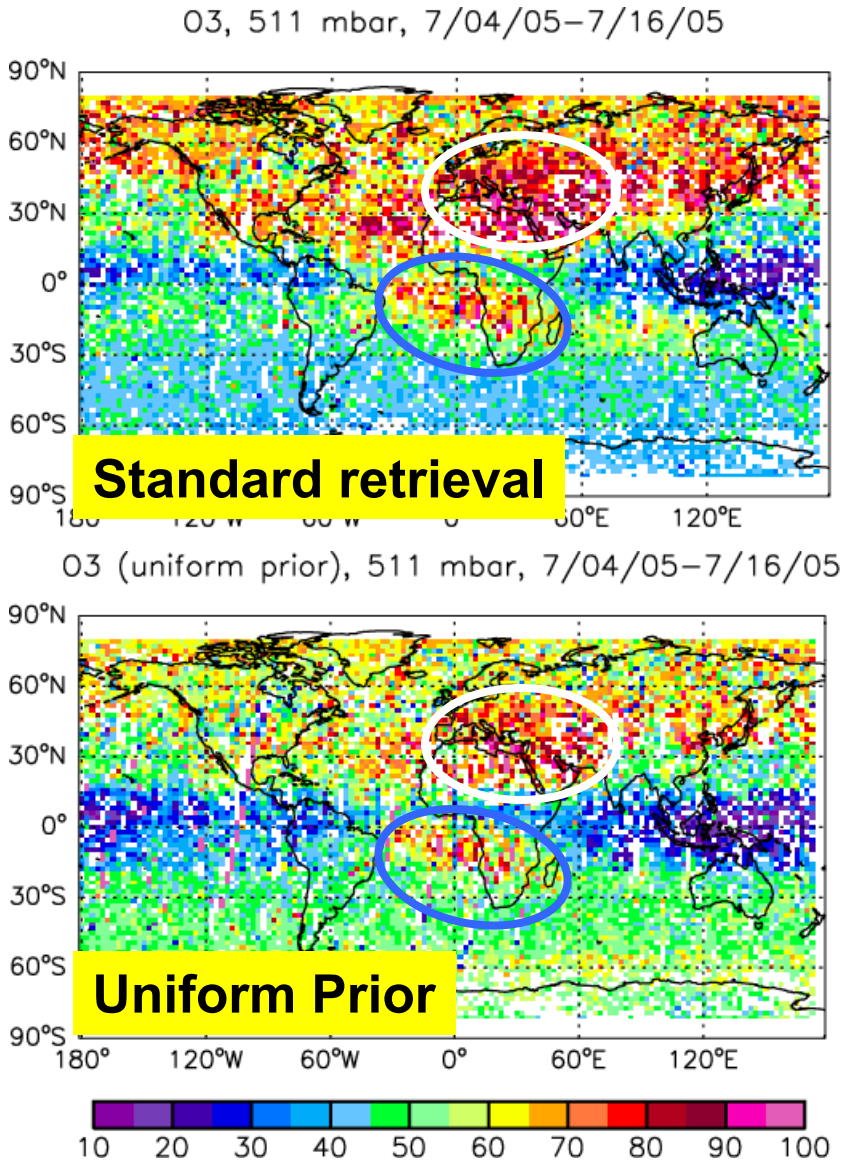


Note:
Blocks in retrieval
Lines at 30 S (O_3),
40, 50 N (CO).





Ozone, July, ~500 hPa



Some features are the same:

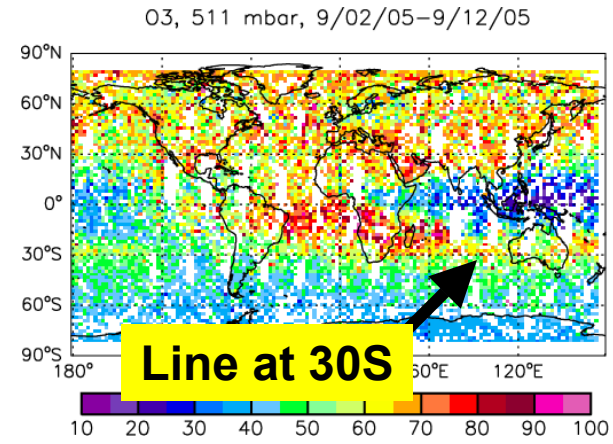
- **Middle East ozone max.**
- **High ozone in S. tropical Atlantic**

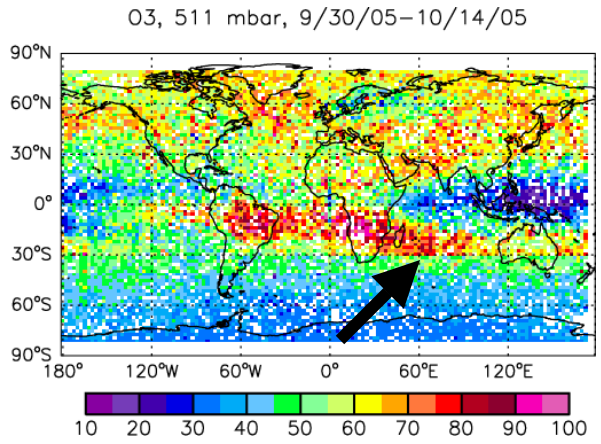
Other features are changed

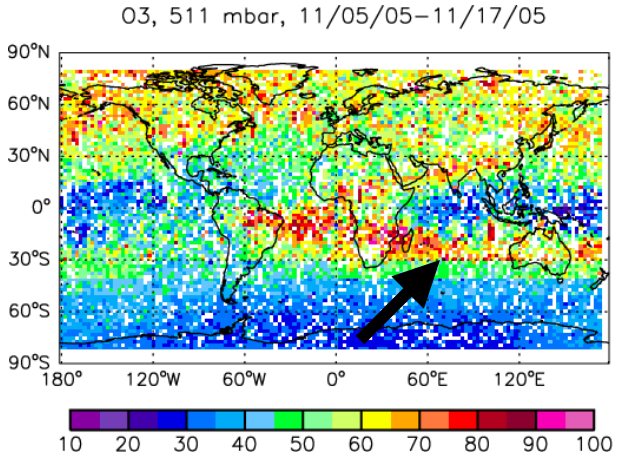
- **Northern pollution belt less obvious**
- **S. tropical ozone plume smaller**
- **The latitudinal gradient is modified**

Ozone, 500 hPa, Sept.-Nov.

Standard Retrieval

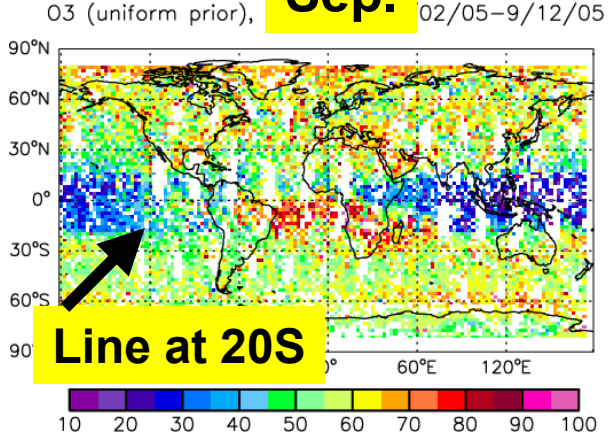




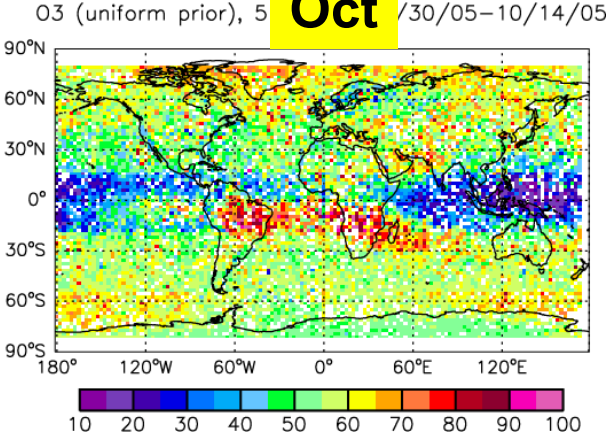


Uniform Prior

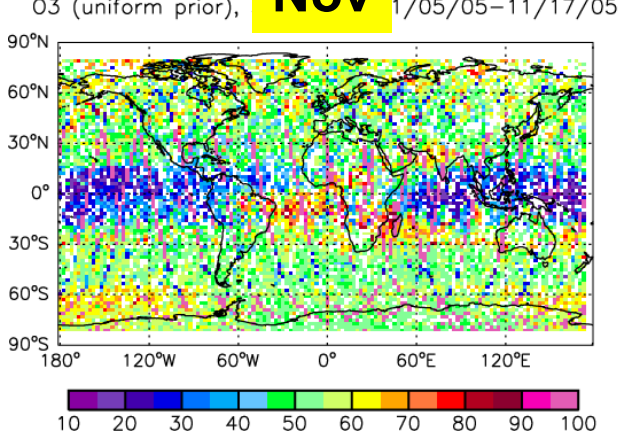
Sep.



Oct

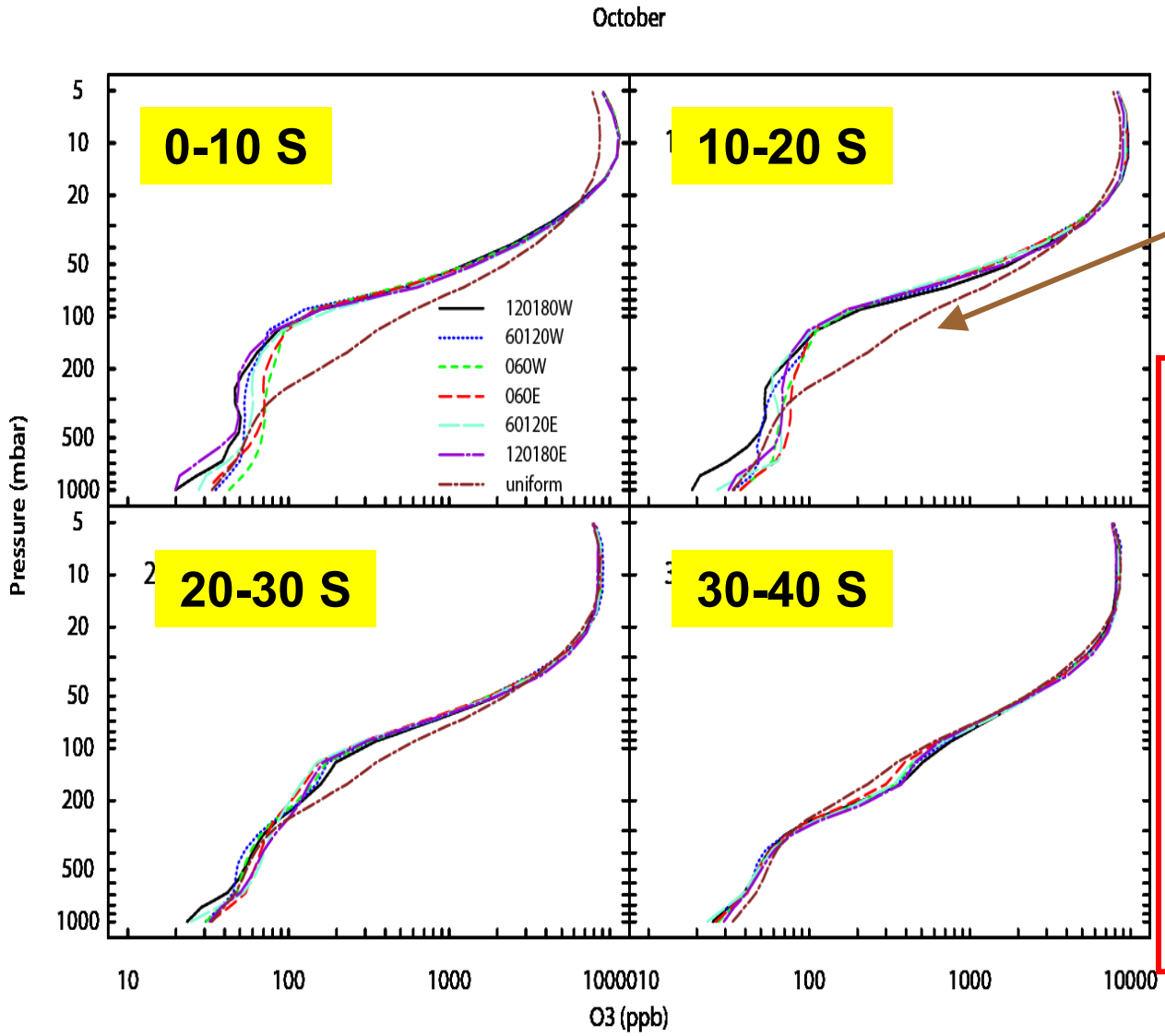


Nov



1. Large plume from S. Africa less clear in November with uniform prior
2. Change in gradient appears at about ±20°: this is where the constraint matrix changes.

Ozone priors from MOZART in October, 10º lat., 60º long. blocks



Brown shows uniform prior

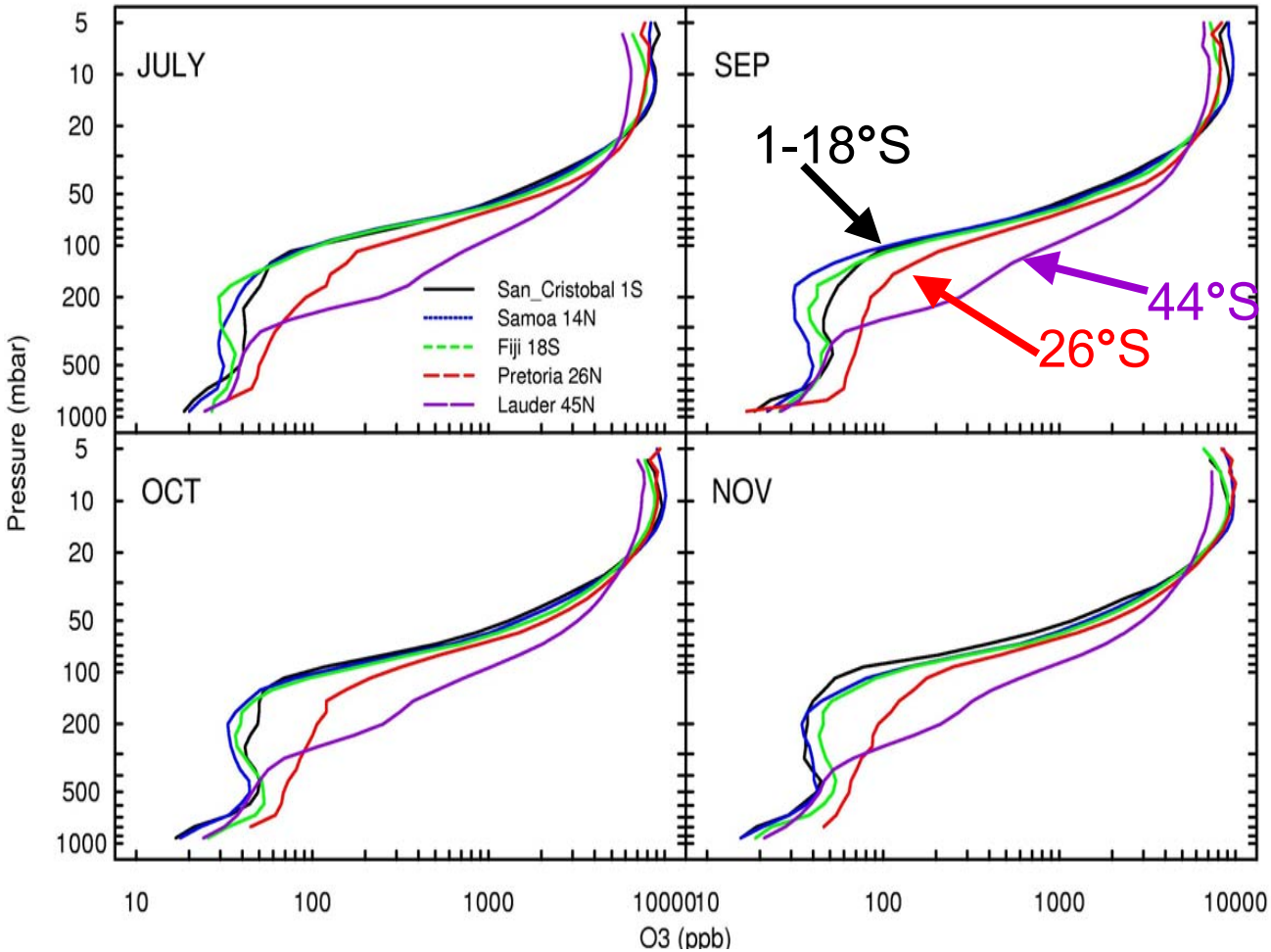
Large change in tropopause height around 30º. Contributes to discontinuity at 30ºS.

AKs show a larger contribution of strat. ozone to trop. ozone at mid-latitudes.

Note: Log scale for ozone, as retrieval is done in log (ozone)

Observed mean ozone profiles for Eq. to 45ºS

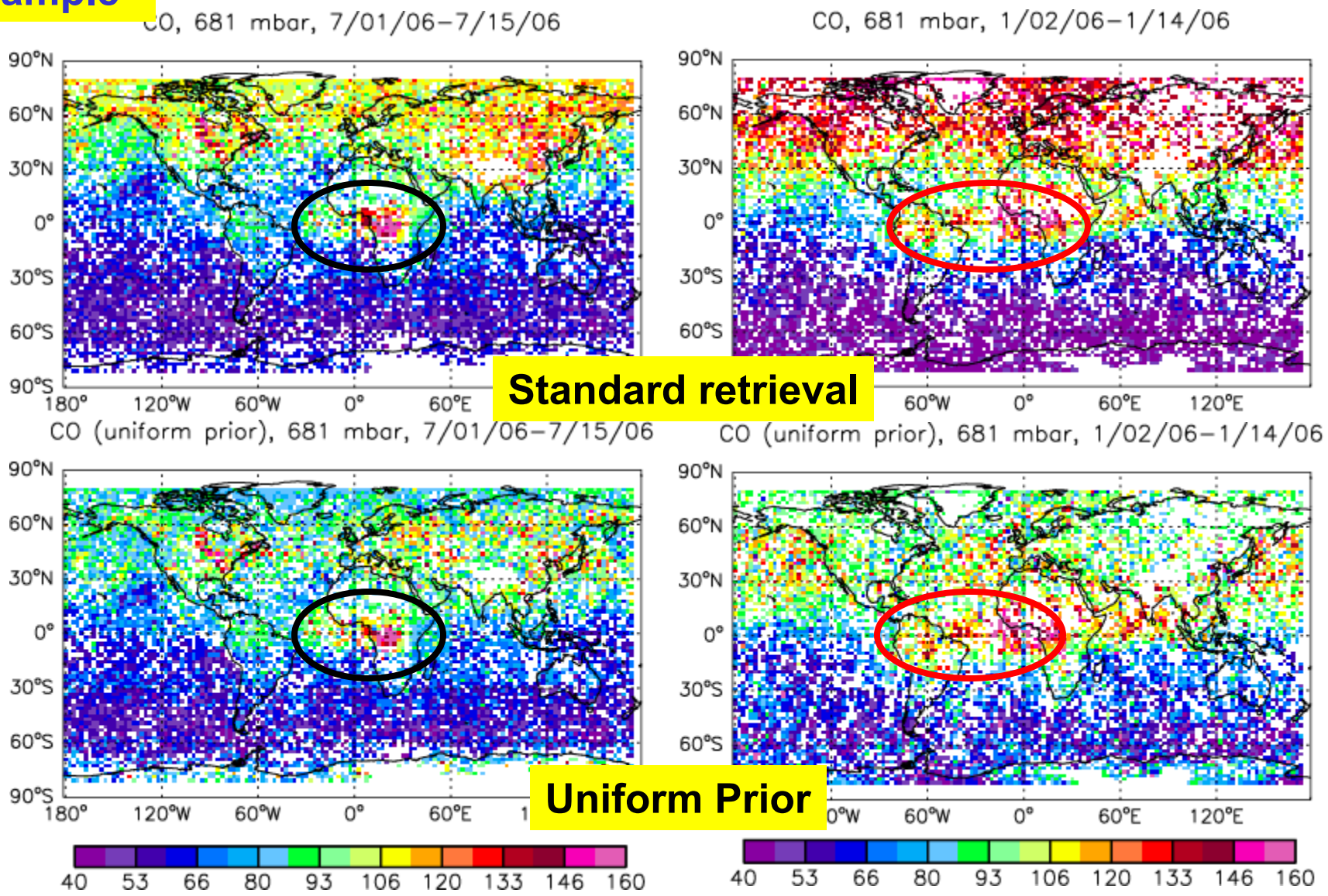
The largest change in shape is from the tropics/sub-tropics to the mid-latitudes (at ~30º), in terms of the tropopause height - so more effect of strat. ozone in retrievals at 500 hPa at latitudes > 30º.



One More Example

CO, July 06

CO, Jan. 06

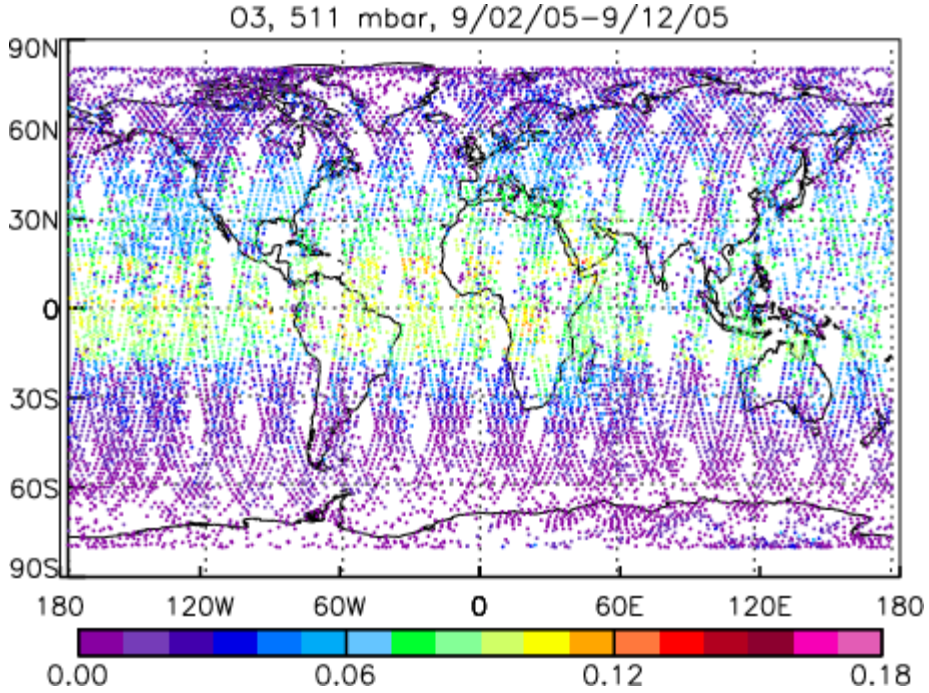


The latitudinal gradient is much less with the uniform prior

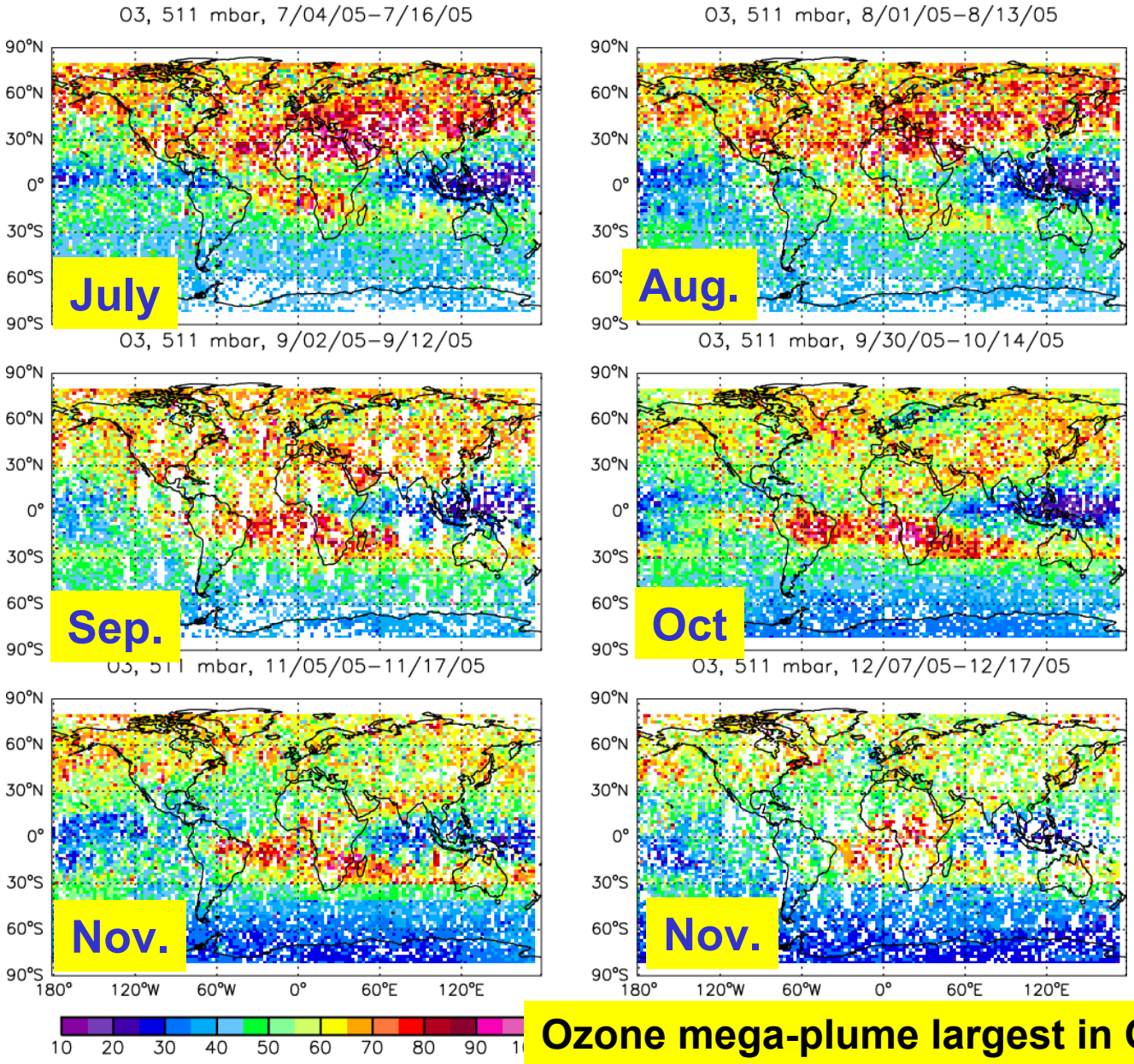
Conclusions

- A uniform prior does not give the best estimate of the global distributions of ozone and CO.
- It can distort the global distributions, e.g., latitudinal gradients.
- TES provides data fields that can be used to assess how much information is from the measurement vs. the prior, e.g, the values of AK diagonal, and the DOFs, and cloud information.
- A uniform prior is useful for some analyses, e.g. in the tropics, where you wish to avoid problems caused by the spatial and/or seasonal patterns in the prior: see Helen Worden's poster.
- The retrieval could be potentially improved to reduce discontinuities near 30° caused by the change in the tropopause height.
- The prior and AKs are taken into account in making comparisons with model, but you want the results to look physically reasonable.

Diagonal of AK at 511 hPa



Ozone at ~500 hPa



Ozone mega-plume largest in Oct-Nov, fading in Dec.